

Tack Coat Best Practices

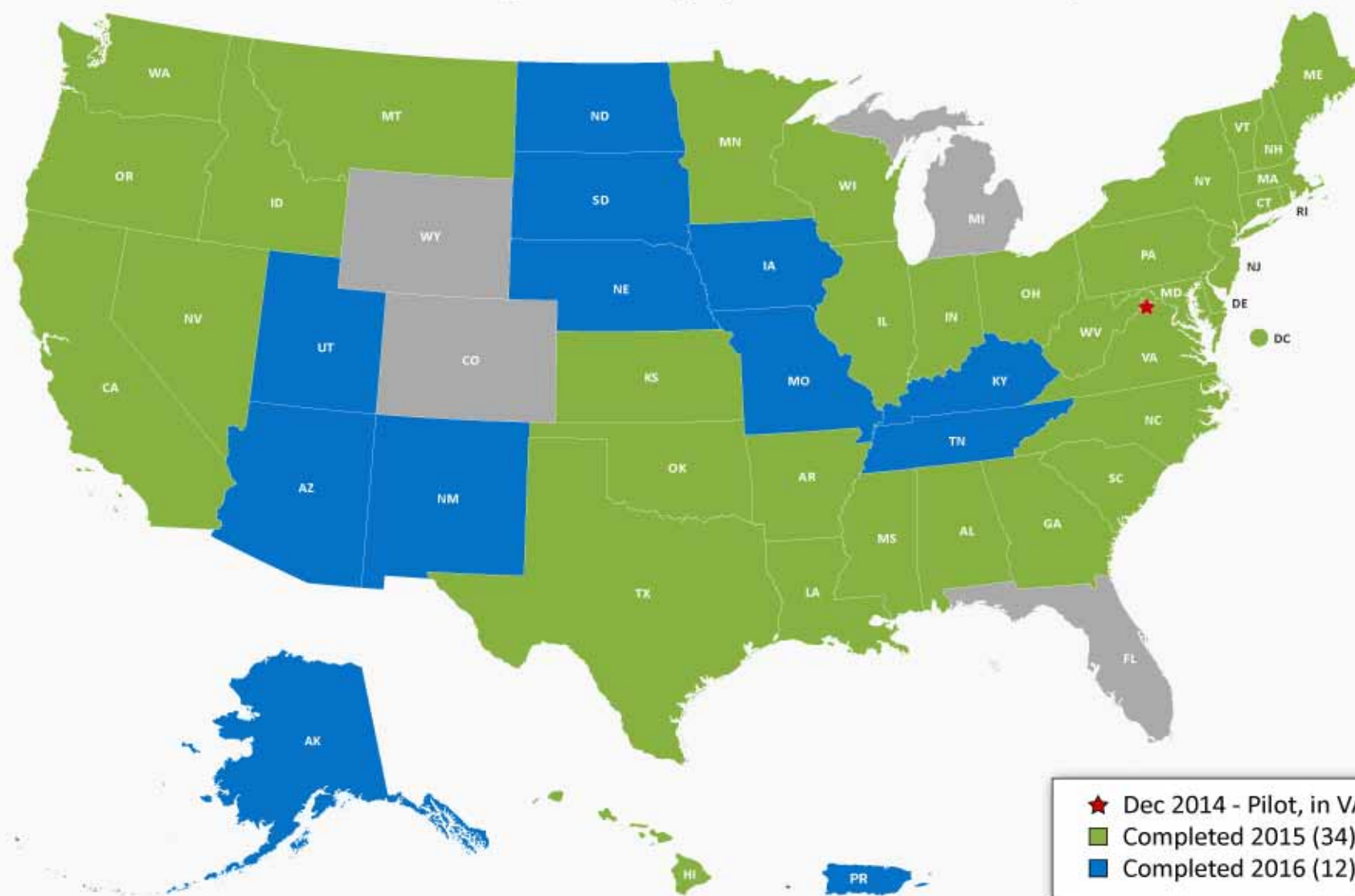


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Tack Coat Workshops, 2015-2016



Reach: 2700 Attendees through 47 workshops, plus additional 3100 with 35 presentations



Purpose of Tack Coats

- To promote the bond between pavement layers.

- Prevent
- Full
- th
- Wh
- Critical uniformly at appropriate
- Apply tack coat on all surfaces including vertical surfaces.

Why do we use
Tack Coats?



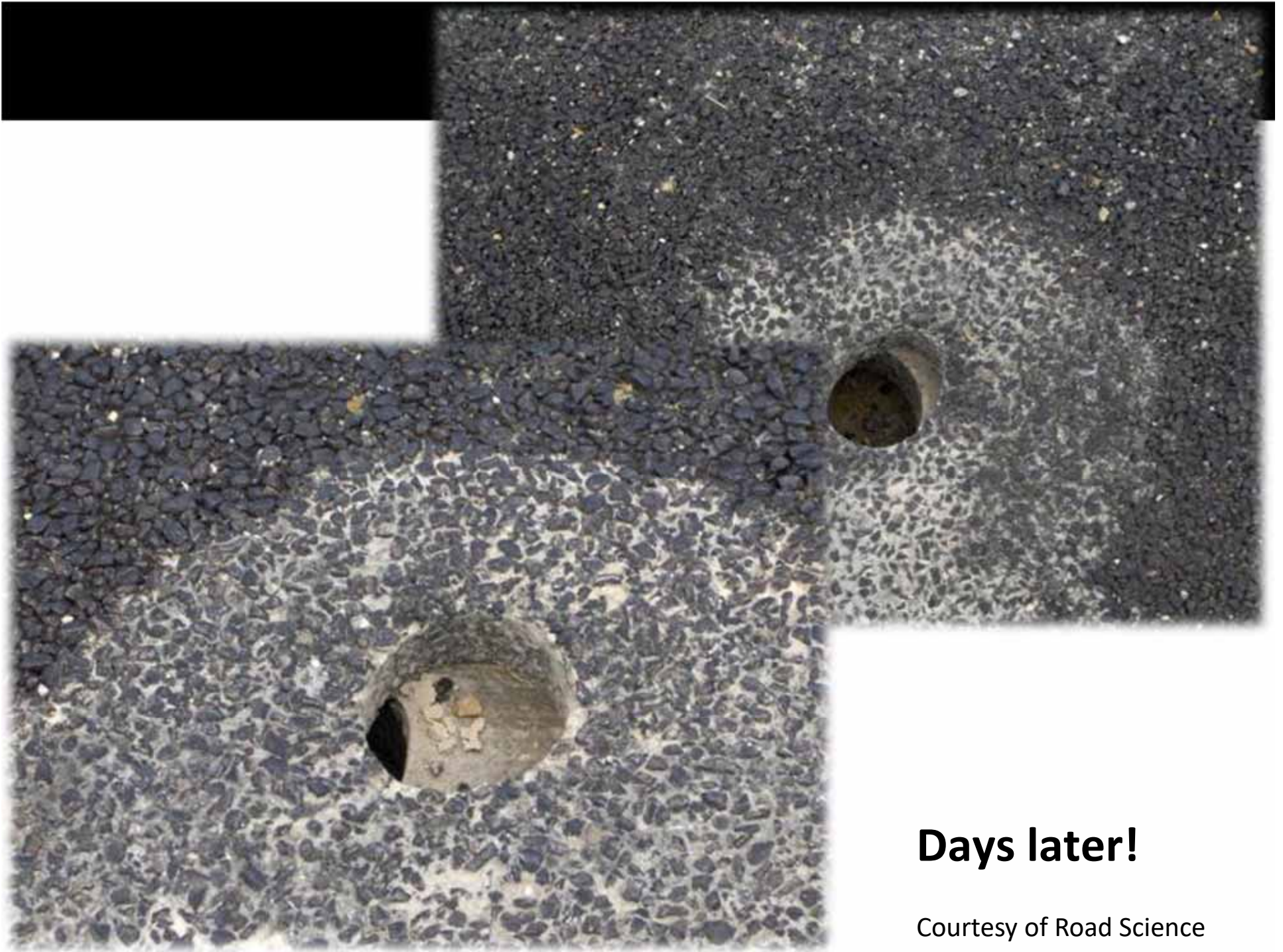
Far too frequent practices



Consequences of Poor Bonding



- Poor pavement performance
 - Slippage cracks
 - Shoving
 - Early fatigue cracking
 - Bottom up
 - Top down
- Costly pavement repairs
 - Repair of isolated area relatively inexpensive
 - Removal and replacement of a portion or the entire pavement structure is very expensive
 - Shorter than expected pavement life can be devastating for agency budgets



Days later!

Courtesy of Road Science

Consequences of Poor Bonding

- Layer independence
 - Reduced fatigue life
 - Increased rutting
 - Slippage
 - Shoving
- Compaction difficulty

Direction of traffic?



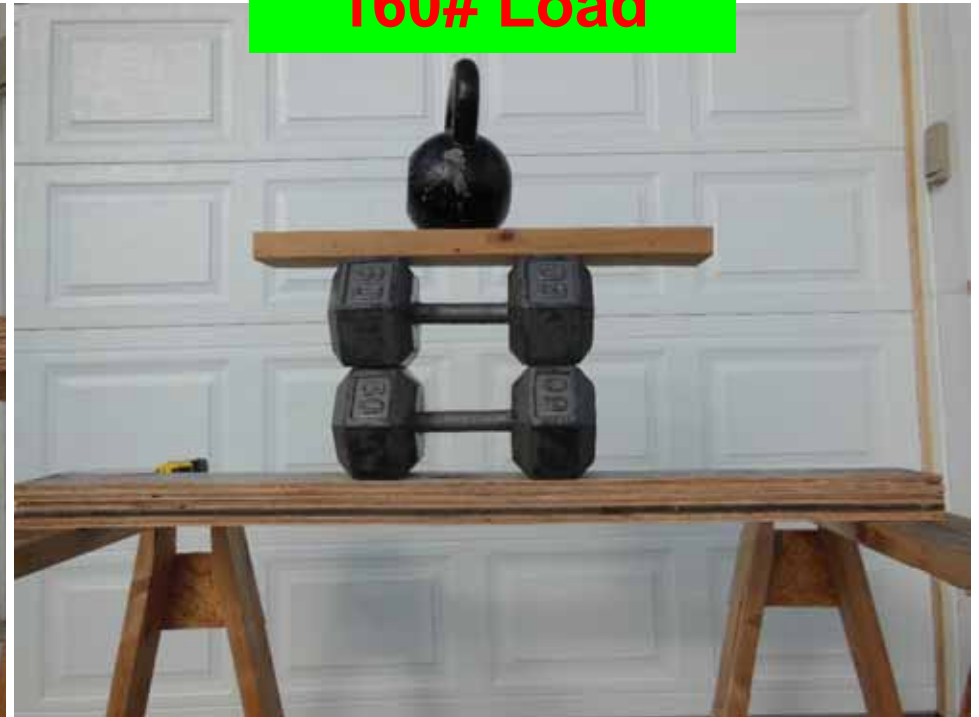
Bonding Demonstration

$\frac{1}{2}$ " Deflection,
60# Load



Unbonded

$\frac{1}{4}$ " Deflection,
160# Load



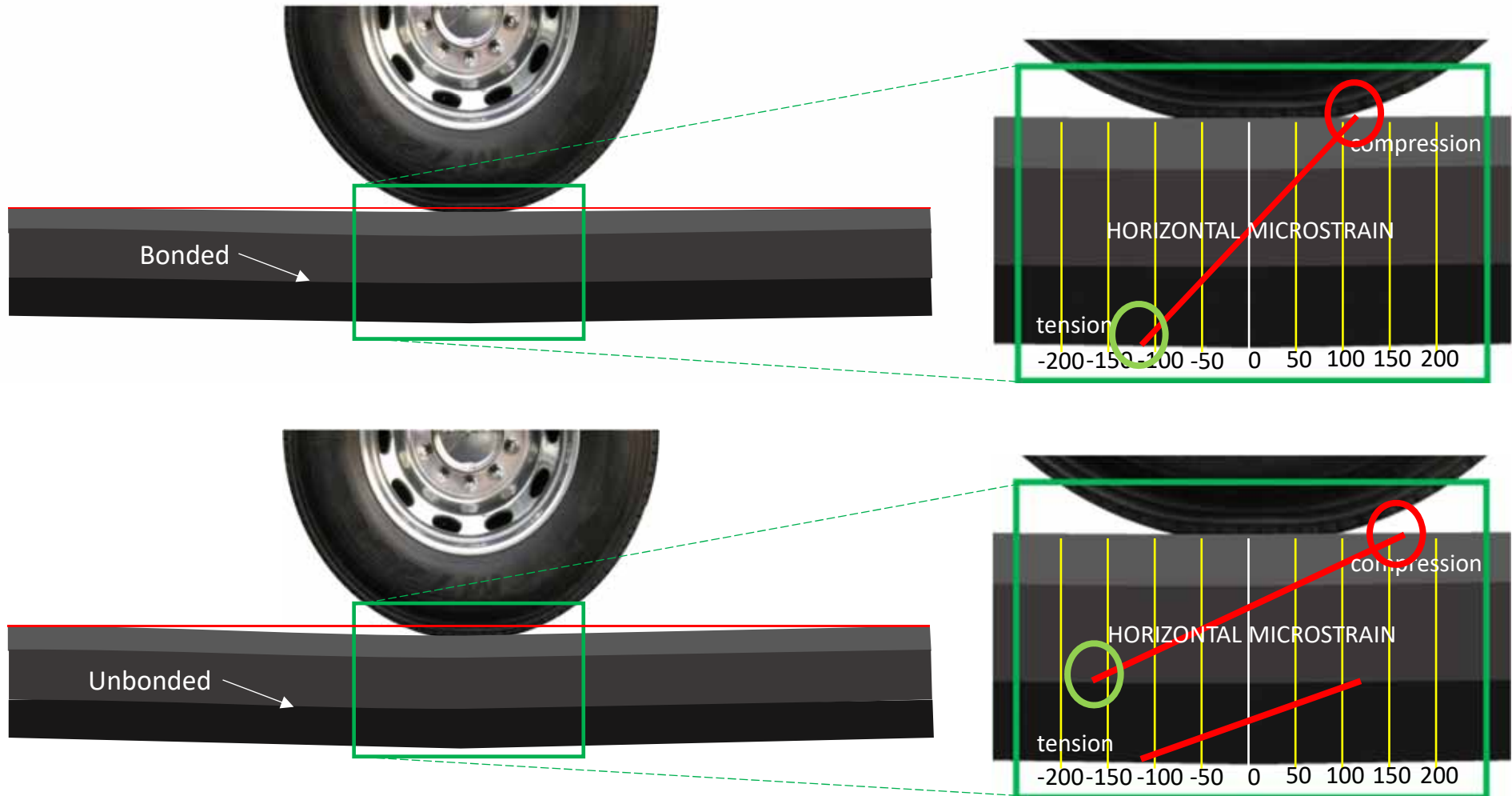
Fully Bonded

Bonding Demonstration Highlights



- 5 unbonded layers deflected **4x more** than 5 bonded with the same loading.
- 2 bonded layers had less deflection than 5 unbonded with the same loading.
- *5 bonded layers with **over 2½x the load** deflected half as much as 5 unbonded.*

Consequences of Debonding



Courtesy of NCAT

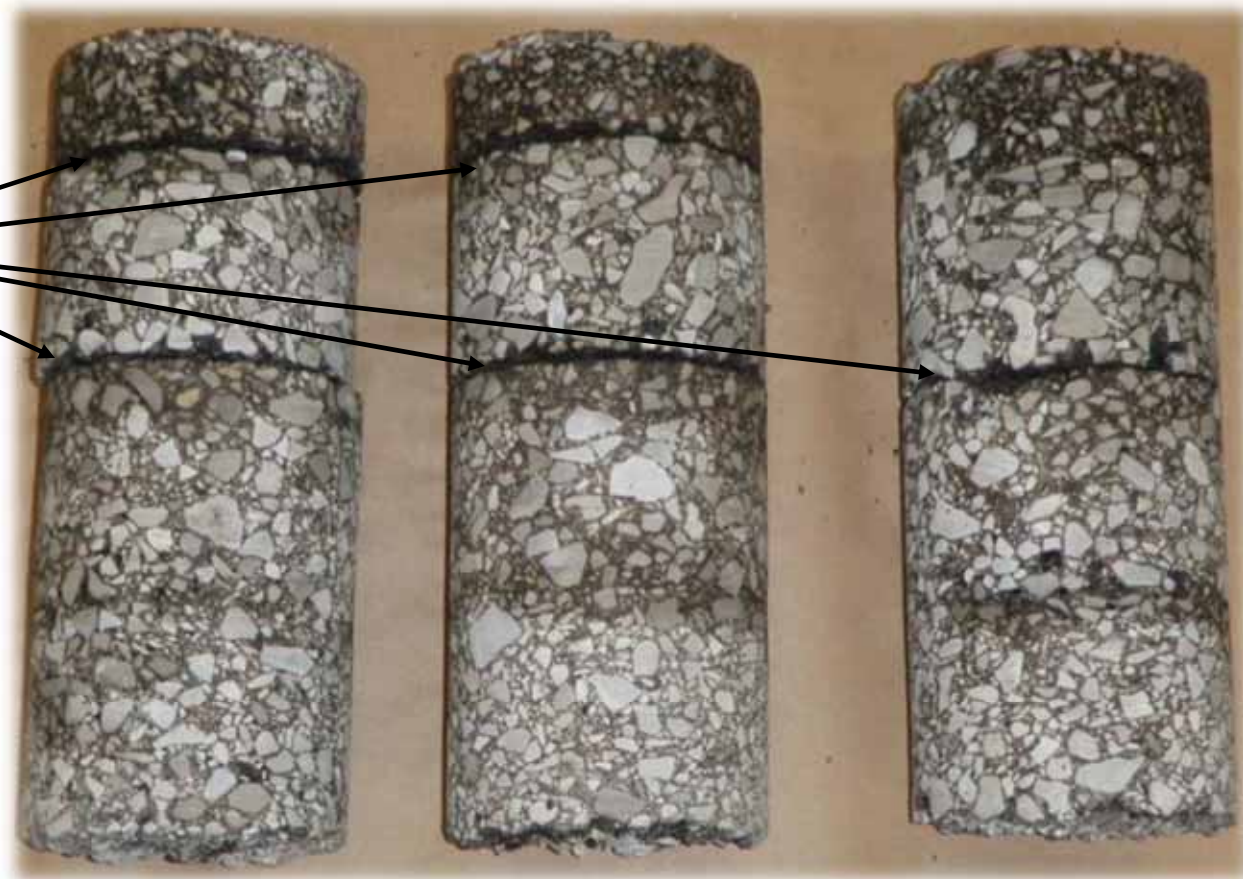
8 – 10 years (est.) Interstate Pavement



Courtesy of MODOT

Cores Showing Debonding

Bonding
Failures



Courtesy of MODOT

Loss of Fatigue Life Research



- May and King:
 - 10% bond loss = 50% less fatigue life
- Roffe and Chaignon
 - No bond = 60% loss of life
- Brown and Brunton
 - No Bond = 75% loss of life
 - 30% bond loss = 70% loss of life

What Does It Cost?

Cost of Tack Coat

- New or Reconstruction
 - About **0.1-0.2%** of Project Total
 - About **1.0-1.5%** of Pavement Total Cost
- Mill and Overlay
 - About **1.0-2.0%** of Project Total
 - About **1.0-2.5%** of Pavement Total Cost

Key Factors for Tack Coat Success



- Condition of Existing Pavement
- Tack Coat Application Rate
- Residual Binder Content
- Proper Distributor Operation
- Emulsion Break and Set Times

Terminology

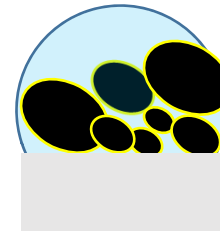
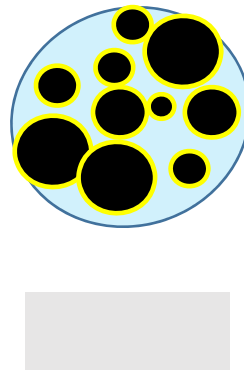
- ***Tack Coat***—sprayed application of liquid asphalt upon an existing asphalt or Portland cement concrete pavement which may or may not have been milled before an overlay, or between layers of fresh asphalt concrete.
- ***Original Emulsion (emulsified asphalt)***—an undiluted emulsion which consists of a mixture of paving grade binder, water, and an emulsifying agent.
- ***Diluted Emulsion***—an emulsion that has been diluted with additional water.
 - Critical to control
 - 1:1 typical (original emulsion: added water)

Terminology



- ***Residual Asphalt***—the remaining asphalt after an emulsion has set typically 57-70 percent.
- ***Tack Coat Break***—the moment when water separates enough from the asphalt showing a color change from brown to black.
- ***Tack Coat Set (cure)***—when all the water has evaporated, leaving only the residual asphalt. Some refer to this as completely broken.

Emulsion Breaking & Setting



Emulsions are asphalt droplets suspended in water

- Breaking
 - Contact with surface changes pH; reducing charge
- Setting
 - Evaporation leads to coalescence
 - Original asphalt characteristics return

Common Tack Coat Materials

- Emulsified Asphalt

- Most common option
 - **SS-1, SS-1H**
 - **CSS-1, CSS-1H**
 - RS-1, RS-1H, RS-2
 - CRS-1, CRS-2
 - PMAE

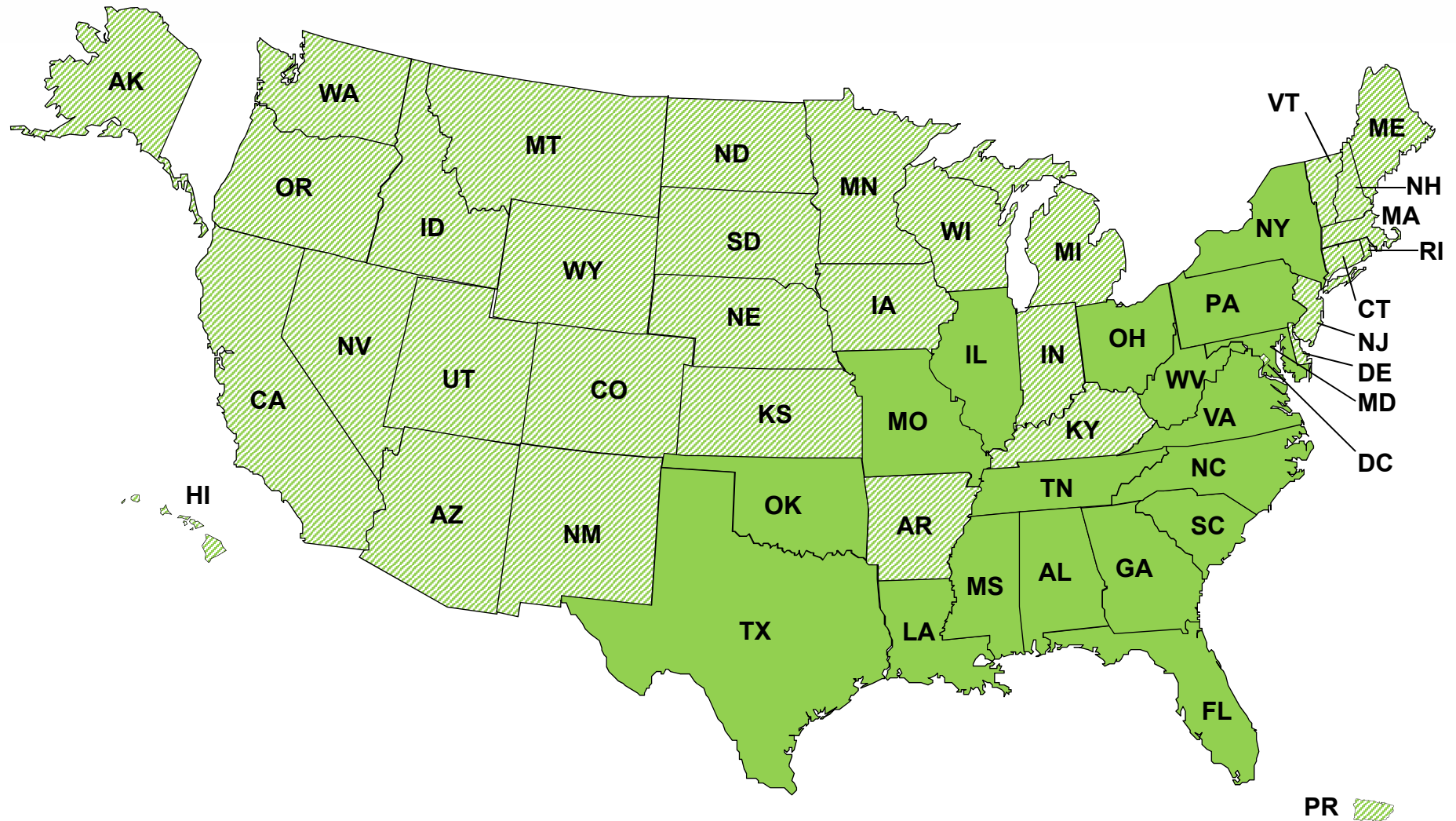
- PG Graded Binders

- Neat Binders
 - PG 58-28
 - PG 64-22
 - PG 67-22
- Polymer Modified

- Reduced or Non-tracking Emulsions



States - Reduced Tracking Tack Mat'ls



- Dilution
 - Verify if it is allowed.
 - If allowed, where?
 - Supplier only?
 - Contractor?
 - Control amount of water added.
 - 1:1 typical (Original Emulsion: Added Water)
 - Use acceptable/approved water.
 - Terminal added or field diluted.
 - Always add water to emulsion.

Tack Coat Challenges



- Contractor
 - Variable application rates
 - Consistency of application
 - Tack coat pick-up or tracking by construction vehicles
 - Breaking/setting time prior to paving
- Agency
 - Acceptance (method or performance)
 - Bond quality testing
 - Dilution?
 - Visual inspection
 - Application rate measurement

Best Practices

- Surfaces need to be clean and dry.
- Uniform application.
- All surfaces are tacked.
- Tack should not be tracked off the road.

Best Practices

- Match application to conditions.
 - Materials
 - Residual rate
- Verify application rate.
- Resist tacking too far ahead of paver.



Distributor Truck Setup

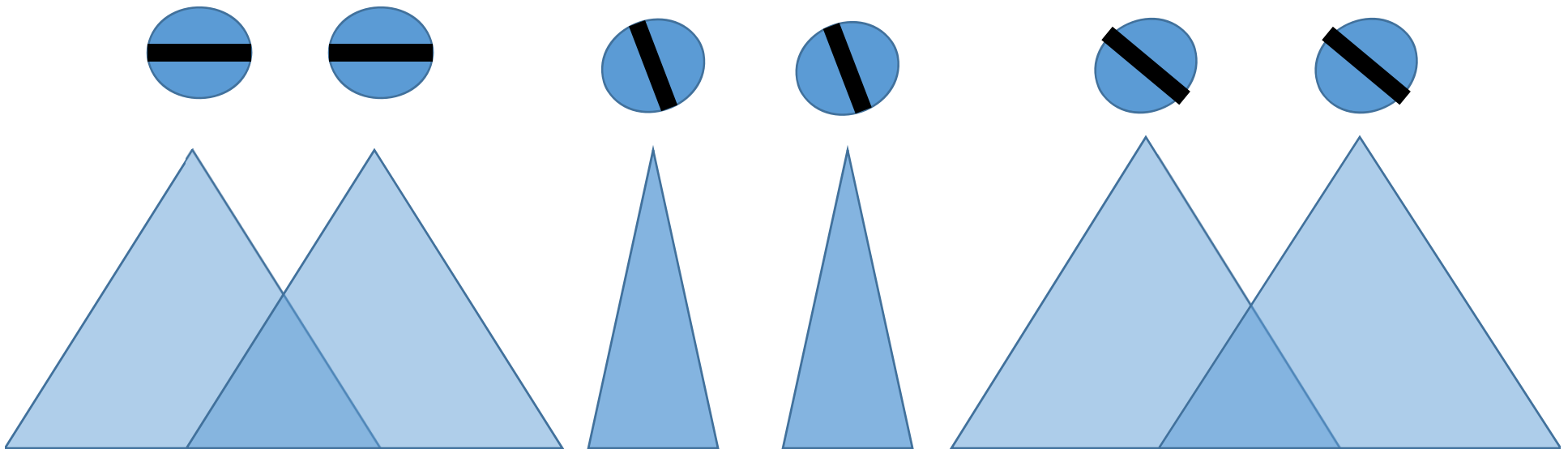


Nozzle Selection

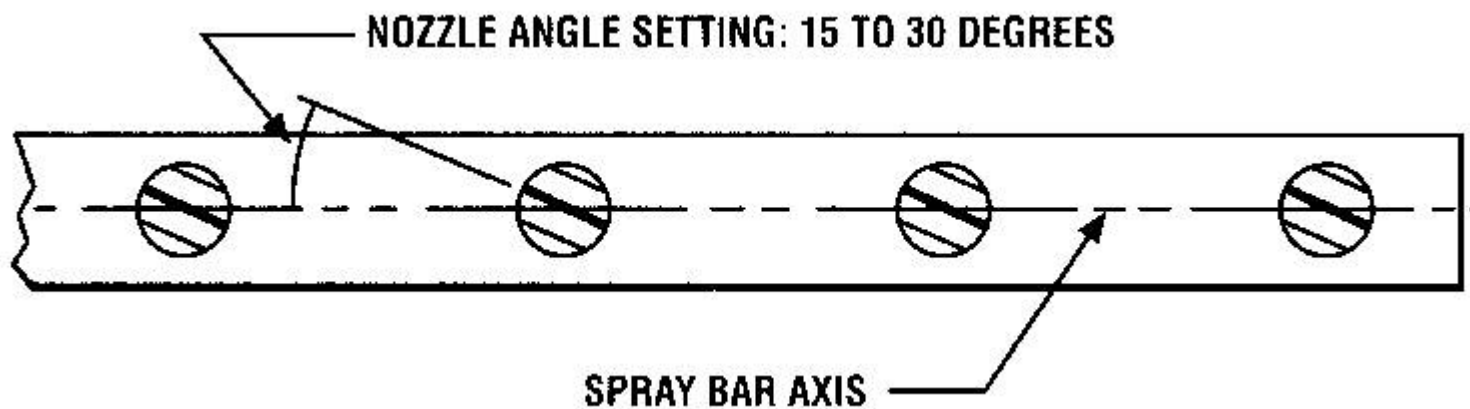
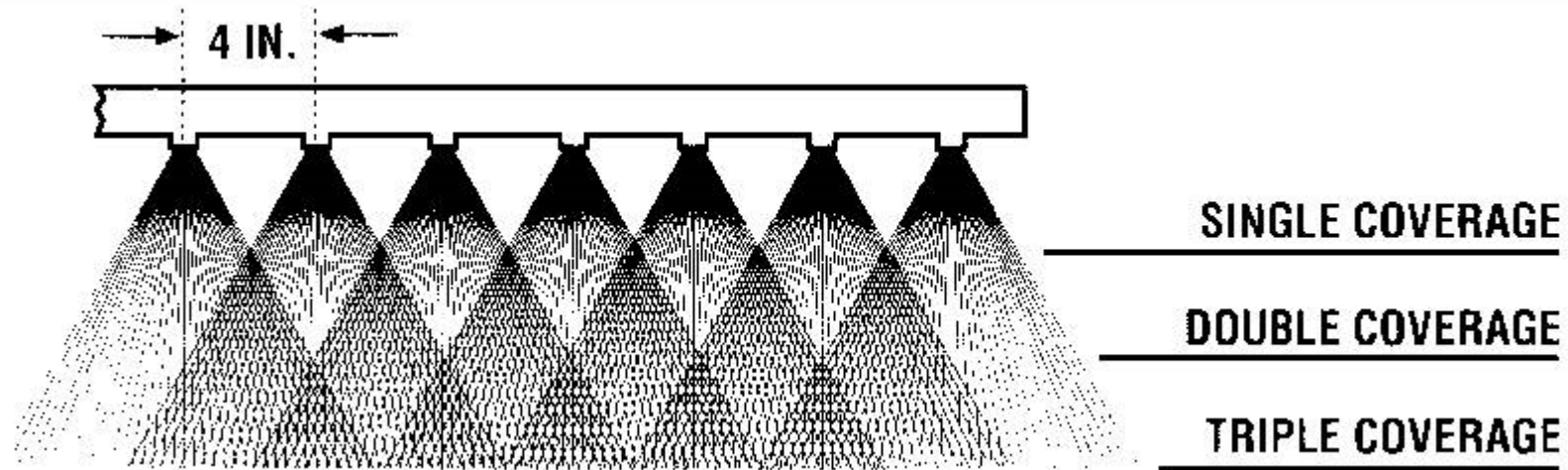


Effect of Nozzle Orientation

Proper nozzle angle of 15-30% assures proper overlap between nozzles without interference of tack streams.



Spray Bar/Nozzles



Nozzles are clogged, but triple overlap covering the gap.



Note: not a tack coat, but principle applies.

Key Items for Inspectors



- Check truck setup.
 - Spray bar height (~12")
 - Appropriate nozzles
 - Nozzle orientation (15-30°)
 - Check application rate gauge in truck
 - Check application temperature
- Collect samples.
- Know the desired application and residual rates.
- Visually inspect application
- Verify application.
 - Volume
 - Mass
 - ASTM D2995



Common Tack Coat Questions



- **Experts commonly disagree**
- “Do I still need to tack...”
 - Milled Surface
 - “Fresh” Pavement
 - Late season/cooler days
- Asphalt Institute recommends tacking all surfaces

Common Tack Coat Questions



- “When can I pave on the emulsion?”
 - Has emulsion broken?
 - Does it need to be set?
- Asphalt Institute recommends paving begin after the emulsion has broken.
- “How can I prevent tack pull-up/tracking?”
 - Make sure tack coat is broken
 - Use emulsions with hard base asphalt (CSS-1h)
 - Use a proprietary reduced-tracking emulsion
 - Use a spray paver

Tracking and Pickup

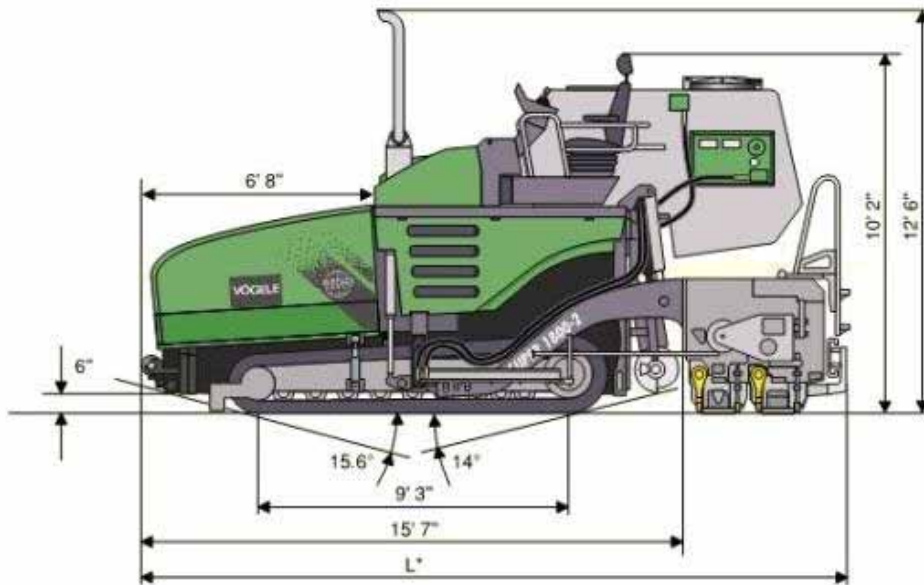


Spray Pavers



- Spray pavers are an engineered system that consists of a paver with built-in emulsion application systems that applies tack just prior to asphalt laydown.
- Emulsions used in spray pavers are designed to perform without break/set.
- No tack coat tracking or pull-up

Spray Paver Illustrations



ROADTEC STEALTH PAVER WITH TACK TANK

Roadtec SP 200 Spray Paver



Courtesy of Roadtec

Vögele: Spray Jet



Courtesy of Road Science

Purported Spray Paver Benefits



- No tracking of the tack
- Better bonding of overlays
 - Increased Overlay life
 - Reduce Rutting
 - Reduce Cracking
- Improved bond = easier compaction

Common Tack Coat Questions



- What is the optimal application rate?
 - Surface type
 - Surface condition
- Asphalt Institute recommended ranges

Surface Type	Residual Application Rate (gsy)
New Asphalt	0.020 – 0.045
Existing Asphalt	0.040 - 0.070
Milled Surface	0.040 – 0.080
Portland Cement Concrete	0.030 – 0.050

Common Tack Coat Questions



- When to Re-Tack?
 - Tracking
 - Contamination

Re-Tack when in doubt.

- Is Dilution okay?
 - Follow state specs
 - Verify dilution amount
 - Can not be used to “stretch” tack as residual value is key.

Limit dilution to supplier.



Areas of Known Agreement



- Layer Bonding is Vital
- Surface Preparation
 - Clean
 - Dry
- Milling Improves Field Performance
 - Shear
 - Cleaning

Areas of Known Agreement

- Application Quality Vital
 - Proper Rate
 - Consistency
- Distributor Truck
 - Setup
 - Calibration/Verification
 - Maintenance
- Tacking of Longitudinal Joints
 - Bonding
 - Confinement



Areas of Known Agreement

- Tack Coat Rate Depends on Surface Condition
 - Fresh
 - Weathered
 - Raveled
 - Milled
- Treat Tack as **Separate Pay Item** vs. Incidental Item
- Need for Research
 - Field Performance
 - Field Testing
 - Bond strength
 - Application amount

Successful Tack Coat

The Ultimate Goal:
Uniform tack coat coverage



Global, International, Regular, Associate and Canadian members



Affiliate and Commercial members





**Free 4-hour workshop
requested through
FHWA divisional offices**



Questions?

Free webinar:

http://www.asphaltinstitute.org/public/asphalt_academy/webinars/tack-coat-best-practices-webinar-recording.dot